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KUNSTSTOFFE vol. 74, no. 6, 1984, MUNCHEN pages 312 - 314; R. LOHL:'Optimierung des Wärmehaushalts von Heisskanaldüsen '

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Description

This invention relates generally to injection molding and more particularly to an injection molding system having a hollow insulation seal seated in alignment with the gate.

Injection molding systems having a heated nozzle seated in a cooled cavity plate with an insulative air space between them are well known in the art, and it is also well known to bridge the air space between them by a nozzle seal or gate insert to prevent leakage of the melt. Examples are shown in U.S. patent number 4,043,740 to Gellert which issued August 23, 1977 and the applicant's Canadian patent application serial number 578,974 filed September 30, 1988 entitled "Injection Molding Nozzle with Replaceable Gate Insert". Edge gated injection molding is also known, as shown in U.S. patent number 4,094,447 to Gellert which issued June 13, 1978. An edge gated system having hollow seals extending radially around each gate is shown in U.S. patent number 4,344,750 to Gellert which issued August 17, 1982. While this arrangement works very well for many applications, in some instances the seals provide excessive heat adjacent the gate which reduces cycle frequency.

From DE Periodical "Kunststoffe 74 (1984), pages 312 to 314 there is known a heated nozzle whereby an insulation is provided between the central portion of the nozzle and the inner wall of a well with which the nozzle is housed.

Accordingly, it is an object of the present invention to at least partially overcome the disadvantages of the prior art by providing an injection molding system with an insulation seal which reduces heat transfer to the immediate area of the gate.

The above object is achieved by the subject matter of claim 1.

Further objects and advantages of the invention will appear from the following description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a sectional view of a portion of an edge gated injection molding system according to one embodiment of the invention,

Figure 2 is an enlarged view showing one of the edge gate seals,

Figure 3 is a cut-away isometric view of the edge gate seal seen in Figure 2,

Figure 4 is a cross-sectional view of the same seal, and

Figure 5 is a sectional view of a portion of a center gated injection molding system according to another embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Reference is first made to Figur 1 which shows a portion of an edge gated injection molding system having a number of heated nozzles 10, each with a number of edge gate seals 12 according to a preferred embodiment of the invention. Each nozzle 10 has a steel main body portion 14 extending from a steel collar portion 16 adjacent the rear end 18. The nozzle is seated in a well 20 in the cavity plate 22 by a circumferential insulation flange 24 which extends from the collar portion 16 and sits on a circumferential shoulder 26. The nozzle has a forward end 28, adjacent which the edge gate seals 12 are seated, as described in more detail below. In this position, the cylindrical outer surface 30 of the main body portion 14 of the nozzle 10 is separated from the inner surface 32 of the well 20 in the surrounding cavity plate 22 by an insulative air space 34. The nozzle 10 has a melt passage with a central portion 36 which extends from an inlet 38 at the rear end 18 and branches into a number of radial portions 40, each of which extends outwardly in alignment with one of the edge gates 42 extending radially outward through the cavity plate 22 to one of the cavities 44.

The nozzle is heated by an electrically insulated heating element 46 which is integrally brazed in a spiral channel in the outer surface 30 of the main body portion 14 and extends to the terminal 48 which projects outwardly or frontwardly from the collar portion 16. The heating element 46 in the channel is covered by a protective nickel casting 50 which is applied as described in U.S. patent number 4,768,283 to Gellert which issued September 6, 1988.

The nozzles 10 are secured by bolts 52 to a common elongated manifold 54 which has a melt passage 56 which branches to a number of outlets 58, each of which is aligned with the inlet 38 to the melt passage through one of the nozzles 10. The manifold 54 is located securely in place between a back plate 60 and the cavity plate 22 by a central locating ring 62 and a titanium pressure pad 64. The back plate 60 is held in place by bolts 66 which extend into the cavity plate 22. The back plate 60 and the cavity plate 22 are cooled by pumping cooling water through cooling conduits 70. The manifold 54 is heated by an electric heating element 72 which is cast into it as described in U.S. patent number 4,688,622 entitled "Injection Molding Manifold Member and Method of Manufacture" to Gellert which issued August 25, 1987. The locating ring 62 bridges another insulative air space 74 provided betwe n th heated manifold 54 and the cavity plate 22.

The rear end of the heating element 46 extends radially outward through a plug 76 which is

secured in a radial opening 78 through the collar portion 16 of the nozzle 10. The terminal 48 is provided by a t rminal body 80 which has a protective cap 82 secured to it as described in detail in Gellert's Canadian patent application serial number 578,975 filed September 30, 1988 entitled "Method of Manufacture of an Electrical Terminal on an Injection Molding Nozzle". The heating element 46 has a nickel chrome resistance wire 84 extending centrally through a refractory powder electrical insulating material 86 such as magnesium oxide inside a steel casting 88.

A thermocouple 90 extends into a diagonal thermocouple bore 92 to measure the operating temperature adjacent the forward end 28 of the nozzle 10.

As more clearly seen in Figures 2 and 3, each edge gate seal 12 has a hexagonal portion 93 extending between a threaded inner end 94 and an outer end 96 with a central portion 98 surrounded by a circular groove 100 and a circular outer flange portion 102. The seal 12 has a central bore 104 extending therethrough which smoothly tapers from a larger diameter at the inner end 94 which matches the diameter of the radial portion 40 of the nozzle melt passage to a smaller diameter at the outer end 96 which approximates the diameter of the edge gate 42. After the seal 12 is screwed securely into place in a seat 106 adjacent the forward end 28 of the nozzle 10, the outer face 108 of the flange portion 102 are ground to match the inner surface 32 of the well 20 in the cavity plate 22. After installation in the well 20, each seal bridges the insulative air space 34 and the central bore provides an extension of the radial portion 40 of the nozzle melt passage in alignment with the gate 42. When the nozzle 10 is heated to the operating temperature, the flange portion 102 expands into bearing contact against the inner surface 32 of the well 20 in the cavity plate 22. As clearly seen in Figure 2, the flange portion 102 extends outwardly a predetermined distance past the face 110 of the central portion to provide a clearance "d" between the face 110 and the inner surface 32 of the well 20. Thus, an insulation space 112 is formed between the central portion 98 of the outer end 96 of each seal 12 and the inner surface 32 of the well 20. This space 112 fills with melt, but the sealing contact of the surrounding flange portion 102 against the inner surface 32 of the well 20 prevents the melt escaping into the insulative air space 34.

In use, the system is assembled as shown in Figure 1 by screwing the edge gate seals 12 into place in the nozzles using the hexagonal portions 93. Electrical power is applied through the lead 114 to the terminal 48 of the heating element 46 of each nozzle 10 and to the heating lement 72 in the manifold 54 to heat the nozzles and the manifold to a predetermined operating temperature. Pressurized melt from a molding machine (not shown) is injected into th melt passage 56 through the manifold 54 according to a predetermined molding cycle in a conventional manner. The pressurized melt flows through the central portion 36 of the melt passage through each nozzle 10 and branches out through each radial portion 40 to the central bore 104 of the aligned seal 12. The melt fills the insulation space 112 between the outer end 96 of the seal and the inner surface 32 and flows through the aligned edge gate 42 and fills the cavity 44. As mentioned above, the flange portion 102 of the outer end 96 of the edge gate seal 12 bears against the inner surface 32 of the well around the gate 42 to provide the necessary seal against the leakage of melt. However, the combination of the provision of the insulation space 112 between the face 110 and the inner surface 32 and the fact that the flange portion 102 is substantially larger in diameter than the gate 42 distances the necessary sealing contact between the heat seal 12 and the cooled cavity plate 22 from the immediate gate area. Thus, the temperature of the cavity plate 22 around the gate 42 is limited without requiring excessive cooling to the cavity plate 22. The clearance "d" and the diameter of the flange portion 102 can be varied depending upon the size of the gate 42 and the gate temperatures required for the particular material to be molded by the system. In this embodiment, the circular groove 100 is provided between the face 110 of the central portion 98 and the surrounding flange portion 102 of each seal to further reduce heat transfer through the relatively thin flange portion 102 to the cooled cavity pate 22. Conductivity is further reduced by making the seals 12 of a titanium alloy. After the cavities are filled, injection pressure is held momentarily to pack and then released. After a short cooling period, the mold is opened along the parting line 116 to eject the molded products. After ejection the mold is closed and injection pressure is reapplied to refill the cavities 44. This cycle is repeated continuously with a frequency dependent on the size and shape of the cavities and the type of material being molded.

Reference is now made to Figure 5 which shows an injection molding system according to another embodiment of the invention. As most of the elements of the system are similar to those of the first embodiment described above, elements common to both embodiments are described and illustrated using the same reference numerals. In this embodiment, each heated nozzle 10 has a melt passage 120 which extends centrally from the inlet 38 in alignm nt with a center gate 122 extending through the cavity plate 22 to a single cavity 124. The insulation gate seal 12 is the sam as

those described above, except it is screwed into a seat 106 in the forward end 28 of the nozzle 10 where the central bore 104 is an alignment with the melt passage 120 and the center gate 122. The flange portion 102 of the seal 12 is substantially larger in diameter than the center gate 122 and the outer face 108 of the flange portion 102 is in bearing contact against the inner surface 32 of the well 20 around the gate 122. The center gate seal 12 similarly has a circular groove 100 extending around a recessed central portion 98 which provides an insulation space 112 between the central portion 98 and the inner surface 32 of the well 20. The operation of this embodiment of the invention is essentially the same as that described above and the description need not be repeated.

While the description of the injection molding system with a flanged insulation gate seal has been given with respect to preferred embodiments, it is not to be construed in a limiting sense. Variations and modifications will occur to those skilled in the art. For instance, the inner end 94 may not be threaded but may just be tightly received in the seat 106. Reference is made to the appended claims for a definition of the invention.

Claims

1. An injection molding apparatus having an elongated heated nozzle (10) with a forward end (28) and a rear end (18), said heated nozzle seated in a well (20) of a surrounding cooled cavity plate (22), an insulative air space (34) extending between the heated nozzle and the surrounding cooled cavity plate, the heated nozzle having a melt passage extending therethrough to convey pressurized melt to an edge gate (42) extending radially outward through the cavity plate to a cavity (44), the melt passage having first portion (36) extending centrally from an inlet at the rear end of the nozzle and a second portion (40) extending radially outward from the first portion to a hollow edge gate seal (12) extending adjacent the forward end of the nozzle in alignment with the edge gate (42), said hollow edge gate seal (12) having a central bore (104) extending theretherough from an inner end (94) of the seal to an outer end (96) of the seal (12), wherein the edge gate seal (12) substantially bridges the insulative air space (34)
   characterized in that
   the outer end (96) of the edge gate seal (12) has a central portion (98) surrounded by a flange portion (102) which proj cts outwardly around the center portion with a circular insulative groove (100) extending therebetween, said flange portion (102) b ing substantially larger in diameter than the edge gate (42), wh rein the inner nd of the dge gate seal (12) is threaded to be removably received in a threaded seat (106) extending radially adjacent the forward end of the nozzle in alignment with the edge gate (42), the central bore (104) through said edge gate seal (12) being in alignment with the second radial portion (of the melt passage) and the edge gate (42).

2. An injection molding apparatus as claimed in claim 1, wherein the melt passage through the nozzle (10) has a plurality of radially spaced second portions (40) extending outwardly from the first central portion (36), each second portion (40) extending to a separate edge gate seal (12) seated in alignment with a separate edge gate (42).

3. An injection molding apparatus as claimed in claim 2, wherein the central bore (104) through each edge gate seal (12) smoothly tapers from a first diameter which matches the aligned radial portion (40) of the melt passage through the nozzle to a second diameter which is smaller than the first diameter and which approximates the aligned gate (42).

4. An injection molding apparatus as claimed in claim 3, wherein each edge gate seal (12) has an engageable nut-shaped portion (93) for assembly and disassembly.

5. An injection molding apparatus as claimed in claim 4, wherein the flange portion (102) of the outer end of each edge gate seal (12) is thin.

6. An injection molding apparatus as claimed in claim 5, wherein the edge gate seals (12) are formed of a titanium alloy.

Patentansprüche

1. Spritzgießvorrichtung mit einer länglichen geheizten Düse (10), mit einem vorderen Ende (28) und einem hinteren Ende (18), wobei
   die geheizte Düse in einer Ausnehmung (20) einer sie umgebenden, gekühlten Kavitätsplatte (22) sitzt,
   sich ein isolierender Luftspalt (34) zwischen der geheizten Düse und der sie umgebenden, gekühlten Kavitätsplatte erstreckt,
   die geheizte Düse einen sich durch sie hindurch rstreckenden Schmelzekanal aufweist, um unter Druck g setzte Schm lze inem sich radial auswärts durch di Kavitätsplatte zu einer Kavität (44) erstreckenden Seitenauslaß (42) zuzuführen, wobei der Schm lzekanal ei-

nen ersten sich zentral von einem Einlaß am hinteren Ende der Düse erstreckenden Abschnitt (36) und einen zweiten Abschnitt (40) aufweist, der sich von dem ersten Abschnitt radial nach außen in eine hohle Seitenauslaßdichtung (12) erstreckt, wobei die Seitenauslaßdichtung (12) eine Zentralbohrung (104) aufweist, die sich durch sie hindurch von einem inneren Ende (94) der Dichtung zu einem äußeren Ende (96) der Dichtung (12) erstreckt, wobei die Seitenauslaßdichtung (12) den isolierenden Luftspalt (34) im wesentlichen überbrückt,

dadurch gekennzeichnet, daß

daß äußere Ende (96) der Seitenauslaßdichtung (12) einen Zentralbereich (98) aufweist, der von einem Flansch (102) umringt ist, welcher nach außen, rings um den Zentralbereich vorsteht, während eine kreisförmige, isolierende Ausnehmung (100) zwischen Zentralbereich und Flansch ausgebildet ist und der Flansch (102) einen wesentlich größeren Durchmesser aufweist als der Seitenauslaß (42), wobei das innere Ende der Seitenauslaßdichtung (12) mit Gewinde versehen ist, um entfernbar in einem Gewindesitz (106) aufgenommen zu werden, welcher sich radial im Bereich des vorderen Düsenendes und ausgerichtet nach dem Seitenauslaß (42) erstreckt, und wobei die Zentralbohrung (104) durch die Seitenauslaßdichtung (112) ausgerichtet ist nach dem zweiten radialen Abschnitt (des Schmelzekanals) und dem Seitenauslaß (42).

2. Spritzgießvorrichtung nach Anspruch 1, wobei der Schmelzekanal durch die Düse (10) eine Vielzahl von radial voneinander beabstandeten zweiten Abschnitten (40) aufweist, welche sich nach außen von dem ersten Zentralabschnitt (36) erstrecken, wobei jeder zweite Abschnitt (40) sich zu einer gesonderten Seitenauslaßdichtung (12) erstreckt, welche in Ausrichtung nach einem gesonderten Seitenauslaß (12) angeordnet ist.

3. Spritzgießvorrichtung nach Anspruch 2, wobei die Zentralbohrung (104) durch jede Seitenauslaßdichtung (12) sich sanft von einem ersten Durchmesser, welcher dem zugeordneten radialen Abschnitt (40) des Schmelzekanals durch die Düse entspricht, zu einem zweiten Durchmesser verjüngt, welcher kleiner ist als der erste Durchmesser und welcher dem zugeordneten Auslaß (42) entspricht.

4. Spritzgießvorrichtung nach Anspruch 3, wobei jede Seitenauslaßdichtung (12) einen ergreifbaren mutterförmigen Abschnitt (93) für di Montage und Demontage aufweist.

5. Spritzgießvorrichtung nach Anspruch 4, wobei der Flansch (102) des äußeren Endes einer jeden Seitenauslaßdichtung (12) dünn ist.

6. Spritzgießvorrichtung nach Anspruch 5, wobei die Seitenauslaßdichtungen (12) aus einer Titanlegierung bestehen.

Revendications

1. Appareil de moulage à injection comportant une buse chauffée allongée (10) ayant une extrémité avant (28) et une extrémité arrière (18), ladite buse chauffée étant posée dans un puits (20) d'une plaque refroidie à cavité (22) qui l'entoure, un espace d'air isolant (34) s'étendant entre la buse chauffée et la plaque refroidie à cavité qui l'entoure, la buse chauffée ayant un passage pour matériau en fusion qui s'étend à travers elle pour amener le matériau en fusion sous pression jusqu'à un trou de coulée latérale (42) qui s'étend dans une direction radiale vers l'extérieur à travers la plaque à cavité jusqu'à une cavité (44), le passage pour matériau en fusion comportant une première portion (36) qui s'étend dans une direction centrale depuis une entrée située à l'extrémité arrière de la buse et une deuxième portion (40) qui s'étend dans une direction radiale vers l'extérieur depuis la première portion jusqu'à un joint creux (12) de trou de coulée latérale qui s'étend contre l'extrémité avant de la buse en alignement avec le trou de coulée latérale (42), ledit joint creux de trou de coulée latérale (12) comprenant un alésage central (104) qui s'étend à travers lui depuis l'extrémité intérieure (94) du joint jusqu'à une extrémité extérieure (96) du joint (12), dans lequel le joint de trou de coulée latérale (12) s'étend sensiblement à travers l'espace d'air isolant (34),

caractérisé en ce que

l'extrémité extérieure (96) du joint de trou de coulée latérale (12) comporte une portion centrale (98) entourée par une portion (102) en bordure faisant saillie vers l'extérieur autour de la portion centrale et ayant une encoche circulaire d'isolement (100) qui s'étend entre ceux-ci, ladite portion de bridage (102) ayant un diamètre sensiblement plus grand que celui du trou de coulée (42) latérale, dans lequel l'extrémité intérieure du joint de trou de coulée latérale (12) est vissée pour être inséré de façon amovible dans un siège taraudé (106) qui s'étend dans une dir ction radiale contre l'extrémité avant de la buse et en alignement avec le trou de coulée latérale (42), l'alésage

central (104) à travers ledit joint de trou de coulée latérale (12) étant en alignement avec la deuxi`me portion centrale (du passage du matériau en fusion) et le trou de coulée latérale (42).

2. Appareil de moulage par injection selon la revendication 1, dans lequel le passage pour matériau en fusion à travers la buse (10) comporte une pluralité de deuxièmes portions (40) espacées qui s'étendent dans une direction radiale vers l'extérieur depuis la première portion centrale (36), chacune des deuxièmes portions (40) s'étendant vers un joint de trou de coulée latérale (12) indépendant et qui est en alignement avec un trou de coulée latérale (42) indépendant.

3. Appareil de moulage par injection selon la revendication 2, dans lequel l'alésage central (104) à travers chacun des joints de trou de coulée latérale (12) s'amincit peu à peu depuis un premier diamètre qui correspond à la portion radiale alignée (40) du passage pour matériau en fusion à travers la buse jusqu'à un deuxième diamètre plus petit que le premier diamètre et qui est proche du trou de coulée aligné (42).

4. Appareil de moulage par injection selon la revendication 3, dans lequel chacun des joints de trou de coulée latérale (12) comporte une portion en forme d'écrou (93) permettant sa mise en prise en vue de son assemblage et son désassemblage.

5. Appareil de moulage par injection selon la revendication 4, dans lequel la portion en bordure (102) de l'extrémité extérieure de chaque joint de trou de coulée latérale (12) est mince.

6. Appareil de moulage par injection selon la revendication 5, dans lequel les joints de trou de coulée latérale (12) sont constitués par un alliage au titane.

FIG.1.

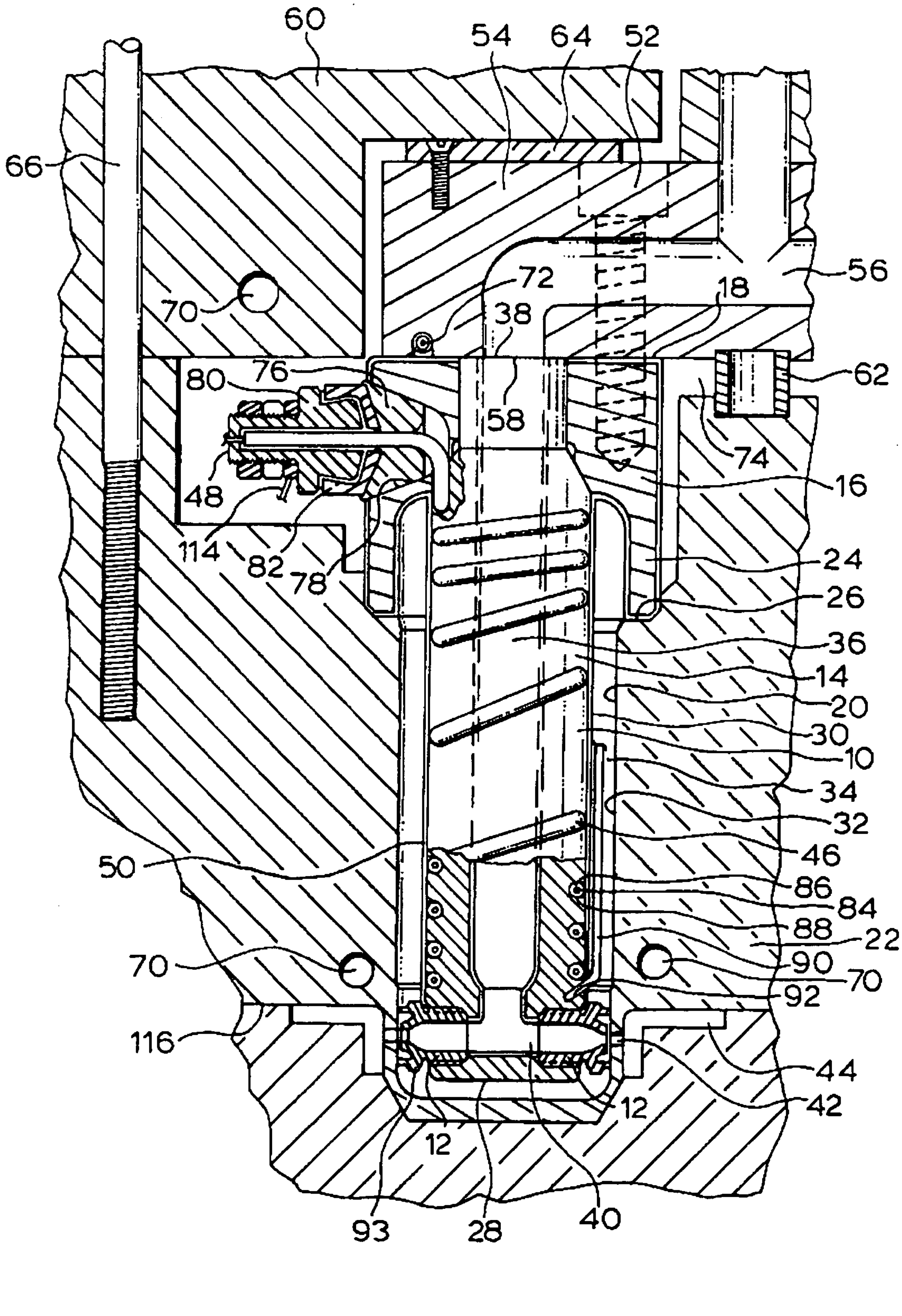
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FIG.2.

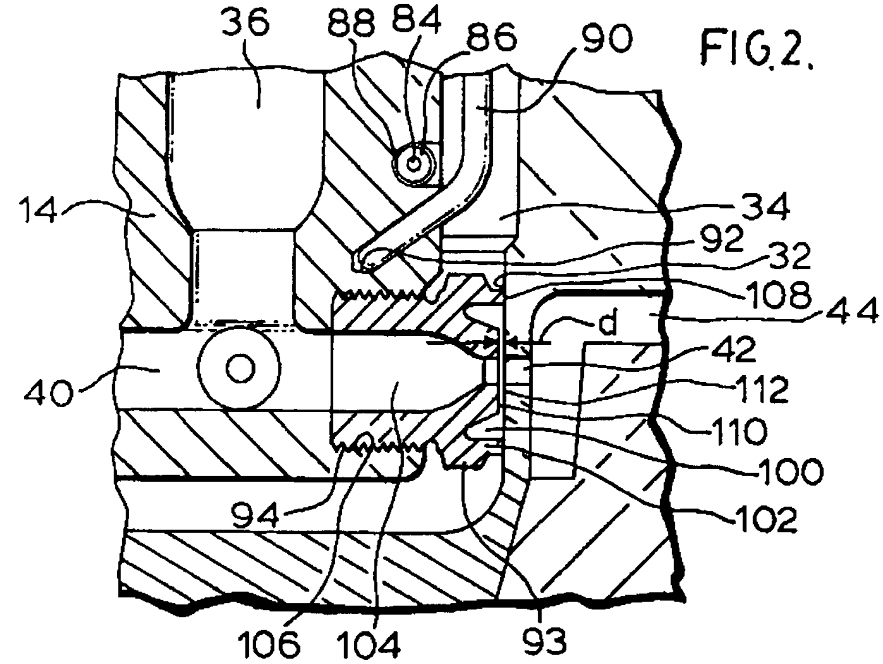


FIG.3.

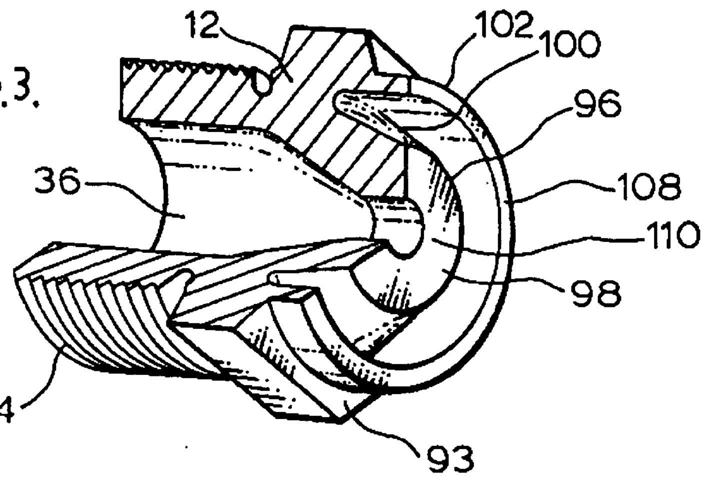


FIG.4.

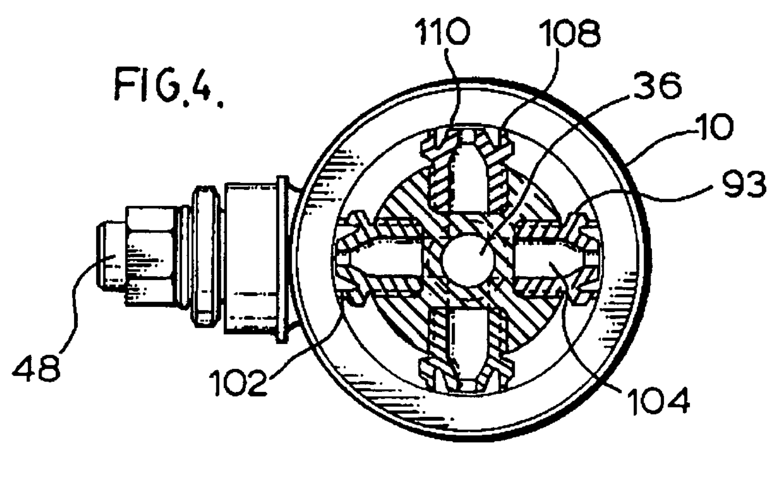
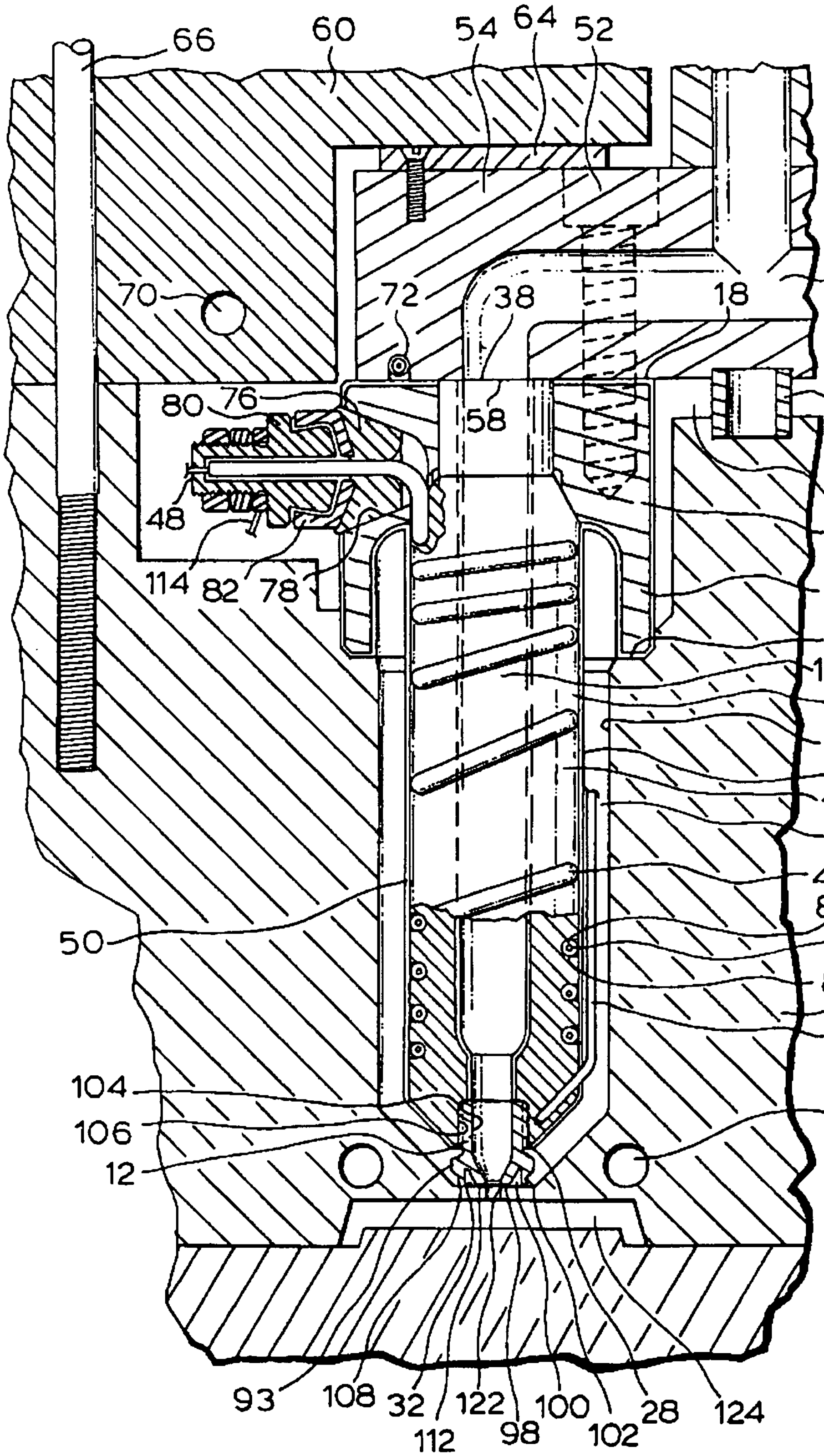


FIG.5.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